

# Appendix A: Methodology

The outreach strategy presented in this report is based on three simultaneous and interrelated research studies conducted between June 2001 and January 2002. The first component of the overall research plan was a *market research study*, which involved a review of the literature in two broad areas: (1) microgravity research and its applications, and (2) the target industry sectors. The goal of this study was to identify the industries that were scientifically, economically and strategically well-positioned to make use of this research opportunity.

The second source of information that guided this plan was the *audience research study*, which consisted of interviews with industry audiences as well as internal NASA audiences to try and distill the factors that might affect an industry partner's decision to participate with NASA. This audience research was critical for identifying the key decision-makers our messages had to reach, and key motivators and barriers, and key message elements that would resonate with these audiences. The study of motivators and influencers for industry audiences also revealed the need to address an additional target audience that was not identified in the original statement of work—the influential public.

Although the audience and market research studies were designed to answer somewhat different questions, in practice they overlapped greatly and supplemented and guided each other.

The third component of our research was a study of NASA's and the CSCs' current marketing materials and media coverage on the topic of space research, particularly space research on the ISS. This *media and materials audit* was designed to help us understand the current media environment and NASA's current marketing strategy.

Thus, our research focused on the following activities:

## Multimedia review of relevant documents

More than 200 documents from NASA, industry, and academic publications were reviewed. These materials included:

- NASA-written or NASA-sponsored reports on microgravity research and its potential, history, present capabilities and future plans for the Space Station, history and current plans for the commercial space program, policies and procedures for commercial participation in space research, and other relevant topics.
- Industry reports and overviews of the target industry sectors.
- Articles in trade magazines, newsletters and peer-reviewed journals
- Materials posted on relevant industry sites (corporations or industry associations)

## Review of NASA and CSC marketing materials and websites

We requested and received a host of current marketing materials used by Headquarters, Office of Space Product Development, and the CSCs. While this audit was not comprehensive and we cannot claim to have looked at every marketing piece currently in use for the ISS or the commercial space program, this audit of brochures and pamphlets, videos, CD-ROMs and other promotional items gave us a good flavor for the range of marketing tactics currently in use.

## **Review of mainstream print media coverage of NASA, the ISS and the Commercial Space Program**

An automated Lexis-Nexis search was conducted for articles on space research published in mainstream news and special interest magazines between June 1 and December 31, 2001. We also requested and received a clipping file from the NASA Public Affairs office.

## **Interviews with NASA and CSC staff**

In-person or phone interviews were conducted with 16 NASA staff members and several CSC staff members, as shown in Tables A and B, respectively.<sup>1</sup> Site visits were conducted to two CSCs (CMDs and CCACS), and the Office of Space Product Development at Marshall Space Flight Center. The NASA and CSC interviews focused on determining NASA and CSC policies and procedures, current publicity/outreach efforts, and directions for microgravity research.

## **Interviews with Members of Target Industries**

Interviews were conducted with 13 individuals with expert knowledge in the target industries, as listed in Table C. These interviews focused on determining perceived benefits and barriers of microgravity research, applicability of microgravity research for industry sectors, decision-making processes, and general perceptions of NASA. In addition, researchers attended the Biotech Industry Organization (BIO) Annual Meeting in San Diego, CA (June 24-27, 2001) to evaluate the potential for space research in this sector and NASA's marketing efforts at this conference.

Separate interview guides were prepared for each audience. Most of the interviews were conducted by trained interviewers and were recorded and transcribed. The information was then summarized and categorized under pre-set areas of inquiry.

All the information from document reviews and interviews was similarly categorized and summarized. As more information became available it was integrated and entered into two information grids, one of which was designed to organize information regarding microgravity research and the other to organize information about the target industry sectors.

This information formed the basis for a series of guided strategy sessions with senior staff members at Equals Three Communications and Booz Allen Hamilton. An analysis of the strengths and weaknesses of NASA's offer from the target audiences' points of view, and the opportunities and threats in the economic, media, and research environments, helped us to identify the most appropriate motivators and messages for each target audience. Using our experience with these audiences, we were able to then identify the most appropriate channels to carry these messages.

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<sup>1</sup> The table lists only those CSC staffers with whom we conducted detailed individual interviews. During our site visits we also spoke with other CSC staff members either alone or in group meetings.

**Table A:**  
**Interviews Conducted with NASA Staff Members**

Name	Title	Location
Barbara Adde	Congressional Liaison, Office of Space Flight	NASA Headquarters
Dr. Lance Bush	International Space Station Commercial Development Manager	NASA Headquarters
Dan Carpenter	Director of Public Affairs	NASA Johnson Space Center
Roger Crouch	Lead Scientist of the International Space Station, Office of Space Flight	NASA Headquarters
Dwayne Brown	Public Affairs Officer	NASA Headquarters
John Emond	Commercial Program Coordinator, Office of Biological and Physical Research	NASA Headquarters
Barry Epstein	Space Station Commercial Marketing Manager and Study Contract Manager	NASA Headquarters, Code U
Dan Hedin	Chief of Staff, International Space Station	NASA Headquarters
Renee Juhans	Public Affairs Officer	NASA Headquarters
Brian Kelly	Manager for Commercialization, NASA Johnson Space Center, ISS Program	NASA Johnson Space Center
Steve Lambing	Associate, Group Flight Center of Space Product Development	NASA Marshall Space Flight Center
Siobhan Mullen	Special Assistant for International Commercial Issues, Office of the Associate Administrator, Office of External Relations	NASA Headquarters
Mark Nall	Manager, Space Product Development	NASA Marshall Space Flight Center
Ned Penley	Lead, Research Mission Management, Payload Office	NASA Johnson Space Center
C. Blake Powers	Director of Research (CST, Inc), NASA Space Development Program	NASA Marshall Space Flight Center
Jim Scheib	Manager of the ISS Payloads, Mission Integration and Planning Office	NASA Johnson Space Center
Elsie Weigel	Public Outreach Coordinator	NASA Headquarters
Phil West	Acting Lead, Communications Office, Office of Public Affairs	NASA Johnson Space Center

**Table B:**  
**Interviews Conducted with CSC Staff Members**

<b>CSC Staff</b>		
Dr. Reed Alexander Ayers	Scientist	CCACS, Colorado School of Mines, Golden
Dr. Ted Bateman	Scientist	Bioserve, University of Colorado, Boulder
Stefanie Countryman	Business Development	Bioserve, University of Colorado, Boulder
Dr. William Gathings	Director	CMDs, University of Alabama, Huntsville
Dr. David Klaus	Scientist	Bioserve, University of Colorado, Boulder
Edward J. Meehan	Scientist	CMDs, University of Alabama, Huntsville
Dr. Frank Schowengerdt	Director	CCACS, Colorado School of Mines, Golden
Laurine Speights	Marketing and Program Development Manager	Bioserve, Kansas State University
Dr. Louis Stodieck	Director	Bioserve, University of Colorado, Boulder

**Table C:**  
**Interviews Conducted with Industry Members**

<b>Name and Title</b>	<b>Firm</b>
Deborah Baly, Director, Cell & Analytical Biology	Bayer Biotechnology
John Cassanto, CEO	Instrumentation Technology Associates, Inc.
Derek Chalmers, Vice President Research	Arena Pharmaceuticals
Bill Chang, Consultant	JDS Uniphase
Parrish Galliher, Vice President Manufacturing	Millenium Pharmaceuticals
Michael Gallatin, Vice President and Scientific Director	ICOS Corporation
Elma Hawkins, Vice Chairman	Antigenics Incorporated
Jaak Holemans, Principal	Booz Allen Hamilton
Jim Hwang, Professor	Northern Michigan Tech University
Frank Koehler, Physics Instructor	San Francisco City College
David Root, Technical Manager Life Sciences	Corning Inc.
William Sheridan, Vice President Product Development	Amgen Inc.
Peter Signor, Vice President Manufacturing	JP Machine Manufacturing

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## Appendix B: Bibliography<sup>2</sup>

- Agra Europe (2001, April 12). Gloomy forecasts at US biotech forum. *Agra Europe*, EP/6.
- American Foundry Society (1999). *Facts and figures about the U.S. foundry industry*. Available at <http://www.afsinc.org/trends/factsandfigures.htm>.
- Arnst, C. (2001, June 18). Breakdown: As funding dwindles, new drugs stall. *Business Week*, 78-79.
- Berg, K. (2001, May 9). Analyst view: Big pharma needs support. *Red Herring Online*. Available at <http://www.redherring.com>.
- BioPharm (2001, April). Biopharmaceutical sales rising. *BioPharm*, 14(4), 19.
- Biotech Industry Organization. (2001). *Guide to biotechnology: Biotechnology industry statistics*. Available at <http://www.bio.org/er/statistics.asp>.
- Black, P., Drake, G., Jossem, L. (Editors). *Physics 2000: Physics as it enters a new millennium*. A compendium prepared for the International Union of Pure and Applied Physics PDF file available at <http://www.iupap.org/reports.html>.
- Bochnowski, S. (2001, May 10). Report sparks genomics debate. *Red Herring Online*. Available at <http://www.redherring.com>.
- Broadwell, M. B. (2000, February). *Intellectual property and the economic development of the International Space Station*. Paper presented to Space Technology and Applications International Forum (STAIF-2000), Albuquerque, NM.
- Brody, R. J. (1996). *Effective partnering: A report to Congress on Federal technology partnerships*. Washington, DC: U.S. Department of Commerce, Office of Technology Policy.
- Bruno, L. (2001, April 12). Transforming big pharma. *Red Herring Online*. Available at <http://www.redherring.com>.
- Bush, L. (2000, February). *Registration and disposition process for International Space Station entrepreneurial offers*. Paper presented to Space Technology and Applications International Forum (STAIF-2000), Albuquerque, NM.
- Center for Commercial Applications of Combustion in Space. (2001). *Market research report* (Internal Report). Boulder, CO: University of Colorado, Boulder, Colorado School of Mines.
- Ceramic Information Center. (2001). *Overview of the United States advanced ceramics and glass markets*. Westerville, OH: American Ceramic Society.
- Champion, D. (2001, June). Mastering the value chain: An interview with Mark Levin of Millennium Pharmaceuticals. *Harvard Business Review*, 108-115.
- ChemExpo. (1999). *Focus: Fine chemicals '99*. Available online at <http://www.chemexpo.com/news/focus/cfm>.
- CMDs (1999). *1998-99 Biennial Report. Consortium for Materials Development in Space*, The University of Alabama in Huntsville.

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<sup>2</sup> This is a selected bibliography only. We have included all major reports and research documents. We have not included all the NASA and corporate web sites, NASA and industry marketing materials, and newspaper and magazine articles that were reviewed.

*Commercial Space Act of 1998*. Public Law 105-303, 105<sup>th</sup> Congress of the United States of America.

Commission on physical sciences, mathematics, and applications. (1998). *A strategy for research in space biology and medicine into the next century*. Washington, DC: National Academy of Sciences.

Committee on materials science research on the International Space Station, National Materials Advisory Board, Commission on Engineering and Technical Systems, National Research Council. (1997). *Future materials science research on the International Space Station*. Washington, DC: National Academy Press.

Committee on Microgravity Research, Space Studies Board, Commission on Physical Sciences, Mathematics, and Applications National Research Council. (2000). *Microgravity research in support of technologies for the human exploration and development of space and planetary bodies*. Washington, DC: National Academy Press.

Committee on Microgravity Research, Space Studies Board, Commission on Physical Sciences, Mathematics, and Applications National Research Council. (1992). *Toward a microgravity research strategy*. Washington, DC: National Academy Press.

Committee on Microgravity Research, Space Studies Board, National Research Council. (1995). *Microgravity research opportunities for the 1990s*. National Academy Press, Washington, D.C.

Couzin, J. (2001, June 18). Gene machines. *The Industry Standard*, 38-43.

Couzin, J. (2001, June 18). The spider to the fly: Drug firms use health sites to snag consumers. *The Industry Standard*, 49.

Dorland Healthcare International. (1998). *Medical and healthcare marketplace guide: Volume I*. Philadelphia, PA: Author.

Ernst & Young. (2000, May). *The economic contributions of the biotechnology industry to the U.S. economy* (Report prepared for the Biotechnology Industry Organization). Washington, DC: Author.

Flaherty, C. J. (2000, February). *Pricing policy, structure and schedule for US resources and accommodations on the International Space Station*. Paper presented to Space Technology and Applications International Forum (STAIF-2000), Albuquerque, NM.

Boorstin, J. (2001, June 11). Bubble, bubble, toil and trouble. *Fortune*, 49.

Fox, C. (2001, June 11). Why stem cells will transform medicine. *Fortune*, 159-166.

Freedonia Group (2000, August). *Pharmaceutical Chemicals to 2004*. Available at <http://www.freedoniagroup.com>.

Goodman, B. (2001, February 15). Can Celera map money into genomics? *Red Herring Online*. Available at <http://www.redherring.com>.

Goodman, B. (2001, March 26). What's next for biotech? *Red Herring Online*. Available at <http://www.redherring.com>.

Gross, N. (2001, June 11). Measuring the muscle of R&D spending. *Business Week*, 99.

Gwynne, P., & Heebner, G. (2001, August). Technologies in drug discovery drug development: The next generation. *Science*. Available online at <http://www.sciencemag.org/feature/e-market/benchtop/drugdiscnew.shl>.



Hart, D., Hansen, N., Legros, J-C., Schramm, L. L. (1997). *Microgravity, industry related research for oil recovery: Space technology and Applications International Forum* (STAIF 97), Second Conference on Commercial Development of Space. Albuquerque, NM: AIP Conference Proceedings 387, Part Two, 761-766, Jan. 26-31.

Hastings' Chariots. (2001). *Why microgravity research?* Available at <http://www.hastingschariots.com/microgravity.html>.

Herrera, S. (2001, June 15 & July 1). Forward patents: Festo case rewrites the rules for biotech. *Red Herring*, 34-35.

Herrera, S. (2001, March 19). Big pharma unlocks genomics. *Red Herring Online*. Available at <http://www.redherring.com>.

Hokkaido National Industrial Research Institute. (2001). *Application of microgravity for technological innovations*. Available at [http://www.hniri.go.jp/chap1/chap1\\_e.html](http://www.hniri.go.jp/chap1/chap1_e.html).

Iwata, E. (2001, February 27). Semiconductor companies sliding with no end in sight. *USA Today*, 1B.

Klaus, D. M. (1998, September). Microgravity and its implications for fermentation biotechnology. *TIBTECH (Trends in Biotechnology)*, 16(9), 369-373.

Klaus, D., Brown, R., & Cierpik, K. (1998). Antibiotic production in space. *Space Technology and Applications International Forum-1998*, 633-637.

KPMG Consulting. (1999). *NASA: Commerce and the International Space Station*. Washington, DC: Author.

Lam, K.S., Mamber, S. W., Pack, E. J., Forenza, S., Fernandes, P. B., & Klaus, D. M. (1998). *Applied Microbiology and Biotechnology*, 49, 579-583.

Lam, R. (1999, January/February). Microgravity research at Bristol-Myers Squibb, Wallingford. *Tie Line* (Internal newsletter), 14(1), 1-2.

Logsdon, J. M. (Editor). (1998). *Exploring the unknown: Selected documents in the history of the U.S. civil space program (Volume III: Using Space)*. Washington, DC: U.S. Government Printing Office.

Lundquist, C. A. (1999) *Materials development opportunities* (Internal report). Huntsville, AL: Consortium for Materials Development in Space, The University of Alabama in Huntsville.

Maeder, T. (2001, June 15 & July 1). Genomics: An odd proposition. *Red Herring*, 38.

Metal Powder Industries Foundation. (2001). *What is powder metallurgy?* Available at <http://www.mpif.org/technology/whatis.html>.

NASA. (1992). *Space Station Freedom utilization conference* (conference report). Washington, DC: Office of Space Flight, Spacelab/Space Station Utilization Program, NASA Headquarters.

NASA. (1998). *Commercial development plan for the International Space Station*. Washington, DC: Author.

NASA. (1998). *NASA internal study: Potential pathfinder areas for commercial development of the International Space Station* (Discussion Draft). Washington, DC: Author.

NASA. (1999). *Intellectual property and the economic development of the International Space Station: Creation, use, transfer, and ownership and protection*. Washington, DC:

Office of the General Counsel, NASA. Available at <http://www.hq.nasa.gov/ogc/iss/main.html>.

NASA. (2000) *International Space Station: User's guide* (release 2.0). Washington, DC: Author. Available at <http://spaceflight.nasa.gov/station/reference/index.html>.

NASA. (2000). *NASA working document: Science and technology research directions for the International Space Station*. Washington, DC: Author.

National Chemistry Week. (2001). *Nanomaterials aboard the space shuttle*. Available at <http://www.chem-inst-can.org/ncw/articles/eshuttle.html>.

Oberg, A. C. (2000, October 26). Citizens in space? What a dream! *USA Today*, 17A.

Office of Technology Policy, Technology Administration, U.S. Dept. of Commerce, (1997). *U.S. Corporate R&D: Volume I*. Washington, DC: Author.

Office of Technology Policy. (2000). *Tech Transfer 2000: Making partnerships work*. Washington, DC: US Department of Commerce, Technology Administration.

Paugh, J., & Lafrance, J. C. (1997). *The U.S. biotechnology industry*. From the series "Meeting the challenge: U.S. industry faces the 21<sup>st</sup> century". Washington, DC: U.S. Department of Commerce Office of Technology Policy.

Rayl, A. J. S. (2001, September). Genes in microgravity. *Discover*, 73-77.

Rittner, M. N. (2001, May). *Opportunities in nanostructured materials: Electronic, magnetic and optoelectronic applications*. Norwalk, CT: Business Communications Company, Inc

Sawyer, K. (2001, May 17). Frustration over the station: Besides delays and noise, international space effort has an altitude problem. *The Washington Post*, A3.

Seibert, G. (2001). *A world without gravity: Research in space for health and industrial processes*. Netherlands: ESA Publications Division.

Semiconductor Industry Association. (2001, August). *Technology: Trends and 2000 technology agenda*. Available online at [http://www.semichips.org/pre\\_stat.cfm?ID=61](http://www.semichips.org/pre_stat.cfm?ID=61)

Shepherd, C., and Payson, S. (1999). *U.S. Corporate R&D: Volume I. Top 500 firms in R&D by industry category* (NSF 00-301). Arlington, VA: National Science Foundation and the United States Department of Commerce.

Space Commercialization Experts Panel (1997). *The International Space Station commercialization study*. Arlington, VA: Potomac Institute for Policy Studies.

Space Commercialization Experts Panel, Potomac Institute for Policy Studies. (1997). *The International Space Station commercialization study*. Arlington, VA: Potomac Institute for Policy Studies.

Space Publications. (1999). *State of the Space Industry: 1999*. Bethesda, MD: Author

Space.com. (2001). *Space news top 50: 2001*. Available at [http://www.space.com/spacenews/top50\\_2001.html](http://www.space.com/spacenews/top50_2001.html)

Specialty chemical sector beats downward trend on Wall Street. (2001, September 10). *Chemical Market Reporter*. Available online at <http://www.chemexpo.com/smronline/stories>.

Stipp, D. (2001, June 25). Bill Haseltine: He's brilliant. He's swaggering. And he may soon be genomics' first billionaire. *Fortune*, 101-112.

Takahashi, D. (2001, June 15 & July 1). Semiconductors: The chip industry's roller coaster is showing signs of more volatility. *Red Herring*, 101-102.

Task Group for the Evaluation of NASA's Biotechnology Facility for the International Space Station, Space Studies Board, Commission on Physical Sciences, Mathematics and Applications, National Research Council. (1988). *Future biotechnology research on the International Space Station*. Washington, DC: National Academy Press.

Technical Insights, Inc. (1999). *Advanced materials update* (4<sup>th</sup> Edition). Available at <http://www.Technical-Insights.frost.com>.

Thiel, K. A., & Fikes, B. (2001, January 19). Five biotech trends . . . and other tales from the J.P. Morgan H&Q life sciences conference. *DoubleTwist Online Magazine*. Available at <http://www.doubletwist.com/news>.

Tooling and Manufacturing Association (2001, July). *Business trends survey: July 2001 business trends results*. Available at <http://www.tmanet.com/trends/main.asp>.

Tullo, A. H. (2001, May 7). Top 75: Annual ranking, chemical producers. *Chemical and Engineering News Online*. Available at <http://pubs.acs.org/cen/>.

Uhran, M. L. (2000, February). *Economic development of the International Space Station*. Paper presented to Space Technology and Applications International Forum (STAIF-2000), Albuquerque, NM.

Wheeler, L. (1998, October 10). Congress passes Commercial Space Act. *Florida Today: Space Online*. Available at <http://www.flatoday.com/space/explore/stories/1998b/101098g.htm>.

Zeolyst International. (2001). *Zeolite-FAQ's*. Available at <http://www.zeolyst.com/html/faq.html>.